

HTO and OBT activity concentrations in soil at the historical atmospheric HT release site (Chalk River Laboratories)

S. B. Kim, M. Bredlaw

*Environmental Technologies Branch, Chalk River Laboratories, Chalk River,
Ontario, K0J 1J0, Canada*

Three HT release experiments have been conducted at Atomic Energy of Canada Limited (AECL)'s Chalk River Laboratories (CRL) site in 1986, 1987 and 1994. The experiments in 1986 and 1987 were short-term HT releases, while the experiment in 1994 was a 12-day HT release experiment. In total 1.1×10^{13} Bq of HT was released. It is important to understand HTO and OBT behaviour following HT release into the environment because HT can be converted to HTO by enzymes in soil. The objective of this study was to determine the depth profile of HTO and OBT in soil and its environmental fate as it cycles among compartments of the terrestrial environment around a historical atmospheric HT-release site. The site has not been disturbed since the historical atmospheric testing conducted in 1994.

At the historical atmospheric HT release site, soils were collected at different depths (0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm, 20-25 cm) from three different locations: at the release point (a), 10 m away from the release point (B) and 20 m away from the release point (C). Litter and plant leaves were also collected if available. HTO and OBT activity concentrations were measured in all samples collected. Water contents were also measured for all samples collected at the three sampling points. The highest water contents were measured in the top layer of soil (0-5 cm) and then decreased gradually with depth.

HTO activity concentrations mostly varied in the litter (0-5 cm) according to season. HTO activity concentrations in tree leaves varied with external environmental conditions (precipitation, humidity, etc.). However, there were no significant differences in the soil depth HTO profile, except at a site chosen for comparison (Cranberry Lake). The ratio of HTO in tree leaves to averaged HTO in soil, at the 3 sampling locations, ranged from 2.41 to 3.25 in July.

Unlike HTO activity concentration, OBT activity concentration was highest in the top soil layers (0-5 cm and 5-10 cm) and the specific activities were significantly higher than HTO. Overall, HTO activity concentration in the soil was less than 20 Bq/L; however, the OBT activity concentration in the top soil layer (0-5 cm) was approximately 1,000 Bq/L fifteen years after the HT release experiments. The results suggested that OBT can be used as an indicator of tritium exposure in the environment following tritium accidents.